edge as those on the chemical side. For example there is the rich field of study concerning the permeability of cell membranes and the viscosity of protoplasm, subjects bearing intimately on the life and activities of all cells, and involving the methods of physics rather than chemistry; there is the study of stimulation and functional response in the excitable tissues, which, especially in its electrical aspects, requires much of the technique and knowledge of the physicist; there is the whole field of the special senses including physiological optics and color vision, all of which may properly be called biophysics; and there is the study of the effects of radiation of various sorts on cell structure and function. All these are large fields offering great possibilities of future development, into which the average biologist is but meagerly equipped to penetrate far without the aid of a physicist with whom he can cooperate in a state of mutual understanding.

How is the situation to be met Undoubtedly most biologists—especially physiologists—would do more effective work if they had given more time to the study of physics, but it is a question how much time they can afford to divert from biological study for this purpose. The physiologist who tries to approximate the training of the professonal physicist, will not have time to acquire the thorough knowledge of biology which he should have. The physicist who must first of all be expert in his own line, can not digress to explore the field of biology with the thoroughness necessary to see where his methods would yield a harvest of data valuable to biology and instructive to himself.

The best answer is probably to be found in cooperation between experts in the two fields. A well-trained physicist with more than average knowledge of biology, cooperating with a physiologist with a good elementary knowledge of physics, should make a team capable of doing valuable work in the field where physics and biology touch—the analysis of vital phenomena.

To this end there should be courses of instruction in biophysics adapted to bringing together the workers in the two fields. Physiology as taught in the best laboratories offers the nearest approach to this which at present exists in most universities. But in physiology the biological side strongly predominates; the physical technique taught is crude compared with that of the trained physicist, and there is little attention given to physical theory. Moreover, physiology is usually taught in medical schools, where it is made to conform to the needs of the prospective physician. Thus it is treated as an applied science rather than as a pure science; it is not primarily adapted as a preparation for research.

A course is being developed at Harvard which, it is hoped, will prove a useful step toward meeting this need. It is offered by the physics department under the designation "biophysics." Through cooperation between members of the departments of physics, zoology, botany and physiology and the Cancer Commission, it is intended that this course shall serve the students of both physics and biology, introducing to the physicists those phenomena whereby living matter shows its chief differences from all other matter, and some of those applications of physics to biology which promise to add substantially to our knowledge, and enabling the biologists to learn something of those aspects of physics which it is most important that they should know.

Alexander Forbes
Harvard Medical School

SCIENTIFIC EVENTS

THE POWER RESOURCES OF CANADA

The Canadian Commission of Conservation is issuing a series of reports upon the power resources of the Dominion, the latest being "Water Powers of British Columbia." According to a review in the *Geographical Journal* it is a large volume of over 600 pages, illustrated by maps and photographs, and it deals with the subject (so far as present knowledge goes) in an exhaustive manner. A "General Introduction" discusses the value of water as a natural resource, explaining the

complicated interrelations between the various uses—*e. g.*, for power, irrigation, navigation, fisheries, domestic supplies, etc.—drawing on the experience of the United States as well as that of Canada, and showing the need for common organization and communal supervision of the various users. A second chapter deals with "Water Power Data," and under this head are given facts showing the recent tendency, particularly marked in the United States, for the control of water-power to become concentrated in the hands of a few great and related groups of financial interests. Succeeding chapters describe the history and present position of legislative control, and most of the remaining part of the volume is devoted to the present utilization and the possibilities of water-power in the Province, and the physical conditions which determine them, viz., relief (including storage facilities) and climate. In this connection a detailed description of the physical geography of each of the river systems is given, and numerous tables of stream-flow, precipitation, and temperature. The scope of the volume is therefore wider than its title would suggest. It may be noted that the surveyed sites give a total of about 3,000,000 H.P., but although this is an advance on earlier estimates, it does not take into account the fact that very large and important areas have been only superficially surveyed or are virtually unknown, nor does it allow for storage improvements.

Another publication of the commission deals with "Power in Alberta—water, coal and natural gas." It first enumerates the water-powers of the Province, which are mainly on the Bow River above Calgary and on the Athabasca River about 150 miles above Lake Athabasca, and then discusses the relative costs and advantages of water-power and steam-power. This leads to a consideration of the coal resources of Alberta. These are enormous, and the report states that they form 87 per cent. of the coal of Canada, and to show what that means one may add that, according to Memoir 59 of the Geological Survey of Canada, the total supply of the Dominion is 1,234,000 million tons, while that of the British Isles is only 190,000 million tons. Allowance has to be made for the facts that of the Canadian total about three quarters consists of sub-bituminous coal or lignite, and that three fifths of the Alberta supply belongs to this group. Making allowance for this, it still remains true that the fuel resources of Alberta are very much greater than those of Britain. Natural gas is at present locally important, but it has an uncertain future. The report ends with a note comparing various methods for the fixation of nitrogen by electricity, a matter which will be of importance when the prairie lands need cheap artificial manures.

FUR SEALS OF THE PRIBILOF ISLANDS

THE regular sealing operations at the Pribilof Islands closed for the season on August 10. The Bureau of Fisheries reports that telegraphic information is to the effect that in the current calendar year through August 10 there were taken on St. Paul Island 21,936 pelts, and on St. George Island, 4,042, a total of 25,978. Of the skins taken, 721 were from seals 7 years of age or older. The figures given are subject to slight correction when final reports are made. The fall killings, made chiefly to supply food for the natives, will add somewhat to the year's total.

The by-products plant which was operated in connection with the sealing operations on St. Paul Island produced approximately 1,800 gallons of oil and 29,000 pounds of meat or fertilizer. The operations of the plant were curtailed because of inability to secure a sufficient number of laborers from the Aleutian Islands.

During the present sealing season the bureau has utilized on St. Paul Island a number of native workmen from St. George Island. This was done without curtailing the proper take of sealskins on St. George. The transfer of the men from St. George to St. Paul was effected by the Coast Guard cutter *Bear* and the bureau's vessel *Eider*.

The Bureau of Fisheries further states that misrepresentations have recently gained currency to the effect that pelagic sealing operations are to be permitted shortly in the North